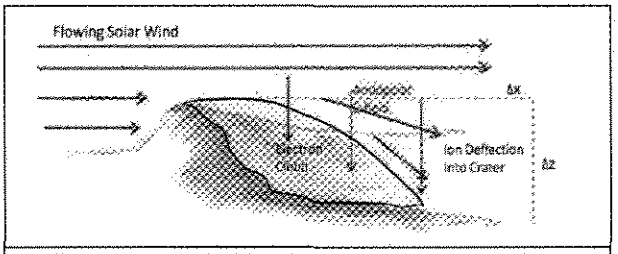
Space Environmental Erosion of Polar Icy Regolith. W. M. Farrell[1,5], R. M. Killen[1,5], R. R. Vondrak[1,5], D. M. Hurley[2,5], T.J. Stubbs[1,3,5], G. T. Delory[4,5], J. S. Halekas[4,5], M. I. Zimmerman[1,5] and the DREAM Lunar Science Institute, [1]NASA/Goddard SFC, Greenbelt MD (William.M.Farrell@nasa.gov), [2]Johns Hopkins/Applied Physics Laboratory, [3]Univ. of Maryland Baltimore County, [4]Univ. of California, Berkeley, [5]NASA Lunar Science Institute, Ames RC, Moffett Field, CA.

While regions at the floors of permanently shadowed polar craters are isolated from direct sunlight, these regions are still exposed to the harsh space environment, including the interplanetary Lyman-α background, meteoric impacts, and obstacle-affected solar wind.

We demonstrate that each of these processes can act to erode the polar icy regolith located at or near the surface along the crater floor. The Lyman-α background can remove/erode the icy-regolith via photon-stimulated desorption [1], meteoric impacts can vaporize the regolith [2], and redirected solar wind ions can sputter the ice-regolith mix [3].



Deflected solar wind ion inflow into a lunar polar crater, redirected by ambipolar processes (from [3])

As an example we shall examine in detail the inflow of solar wind ions and electrons into polar craters. One might expect such ions to flow horizontally over the crater top (see Figure). However, we find that plasma ambipolar processes act to deflect passing ions into the craters [3]. We examine this plasma process and determine the ion flux as a function of position across a notional crater floor. We demonstrate that inflowing solar wind ions can indeed create sputtering along the crater floor, effectively eroding the surface. Erosion time scales from sputtering will be presented.

We shall also consider the effect of impact vaporization on buried icy-regolith regions. There will also be a discussion of solar wind electrons that enter into the PSR, demonstrating that these also have the ability free surface-bound atoms via electron stimulated desorption processes [1].

References: [1] Thrower J. D. et al., J. Vac. Sci. Technol., A 28, 799, 2010. [2] Cintala, M. J., J. Geophys. Res., 97, 947, 1992. [3] Farrell W. M. et al., J. Geophys. Res. 115, E03004, 2010.